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APTA Bus Maintenance Training
Working Group

Training Syllabus to Instruct/Prepare for the ASE Transit Bus Diesel Engines Test

Abstract: This *Recommended Practice* provides guidelines for establishing a standardized bus maintenance training program related to the ASE certification program syllabus for the diesel engines used in transit buses and coaches.

Keywords: Automotive Service Excellence (ASE) H2, bus, certification, diesel engines, training, transit

Summary: This *Recommended Practice* allows users to instruct/prepare transit bus technicians and mechanics for the National Automotive Service Excellence (ASE) H2 Transit Bus Diesel Engines Test and to evaluate, develop or enhance current training programs for the diagnosis, repair and maintenance of transit bus diesel engines systems. Individual operating agencies should modify these guidelines to accommodate their specific equipment and mode of operation.

Scope and purpose: This *Recommended Practice* reflects the consensus of the APTA Bus Standards Program members in conjunction with transit labor organizations, including ATU and TWU, on the subject material, manuals and textbooks, test equipment, methods and procedures that have provided the best performance record based on the experiences of those present and participating in meetings of the program task forces and working groups. APTA recommends the use of this document by organizations that have a training department or conduct training for the maintenance of transit buses, organizations that contract with others for transit bus maintenance training, and organizations that influence how training for transit bus maintenance is conducted.

This Recommended Practice represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system's operations. In those cases, the government regulations take precedence over this standard. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit agencies, may be either more or less restrictive than those given in this document.



Participants

The American Public Transportation Association greatly appreciates the contributions of the **Bus Transit Standards Maintenance Training Working Group**, which provided the primary effort in the drafting of this *Recommended Practice*.

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1. Learning environment

For best application of this *Recommended Practice*, a combination of classroom lectures, mentoring, practical training and practice tests should be included in the training program.

2. Computer skills

Basic computer skills are now a standard for transit bus technicians. Basic skills and knowledge in the operation of a computer in a Microsoft Windows environment is essential.

3. Questions format

In order to standardize the question-and-answer format, the ASE format of questions has been adopted. This type of test uses six question formats, discussed in the following sections.

3.1 Direct question

The correct answer, one out of four potential answers, must be chosen to answer a direct question.

3.2 Completion question

The correct answer, out of four potential answers, must be chosen to complete the statement.

3.3 Illustrated question

Referring to an illustration, the correct choice must be indicated.

3.4 Technician A and Technician B with stem

With this question, the choice is made as to which technician statement is correct, or if both technician statements are correct or incorrect. A lead-in or descriptive statement prefixes the statements

3.5 Technician A and Technician B without stem

With this question, the choice is made as to which technician statement is correct, or if both technician statements are correct or incorrect.

3.6 Except

This type of question is sometimes referred to as a negative question because the choice is the incorrect answer. In the answers presented to the question or statement, all of them can be correct EXCEPT one. In this type of question, the word EXCEPT will be capitalized.

4. ASE course tasks

Tasks that should be covered in this training course:

5. Course descriptions and objectives

TABLE 1
Transit Bus Brakes Learning Objectives

101 SAFETY	
Learning Objectives	ASE Task Reference
Demonstrate proper use of personal protective equipment (PPE)	B1
Explain safety procedures used while working with batteries	G3
101 THEORY & UNDERSTANDING	
Learning Objectives	ASE Task Reference
Describe transit agency service procedures	A18
Demonstrate basic computer knowledge	A1
Identify basic vehicle components (vehicle familiarization)	F1(1)
Demonstrate familiarization with engines and engine equipment	A2
Identify engine type and sub system components	A17
Identify fluid types (oils, coolants, etc.) and explain viscosity	A2
Explain the difference between types of lubricants	A15
Explain the difference between types of coolants	A14
Describe differences and applications of distributor and in-line type injection pumps and mechanical unit injectors	F1(678)
Describe manufacturer's engine test procedures	G7, G8
Demonstrate basic knowledge of starting and charging systems	A11
Demonstrate basic knowledge of air start system	A11
Locate fuel system components on engine	D2
Identify vendor publications (service bulletins, manual updates, etc.) used during maintenance	A18
Demonstrate the proper use of MSDS (Material Safety Data Sheet) for understanding of cleaning chemical safety	B1
Describe differences between sensor and sending unit	D7
Describe the function of rigging and lifting equipment	B1
Describe the importance of a clean work environment	B1
Describe the importance of cleaning parts and equipment prior to disassembly or removal	B1
Demonstrate uses of manufacturer's specification	F1(4)

TABLE 1
Transit Bus Brakes Learning Objectives

101 TOOL USAGE	
Learning Objectives	ASE Task Reference
Identify common gauges	A6, A10, A14, A15
Demonstrate use of fuel gauge, vacuum gauge, pressure gauge/mercury manometer	A1, A7, A8, F1(1)
Demonstrate use of air pressure gauges	E7
Use air pressure gauges to check supply to knock-off cylinders	F1(12)
Demonstrate use of hydrometer and or refractometer	A14
Explain use of test Ph strips	A14
Identify proper diagnostic equipment and demonstrate use	A16
Demonstrate the proper use of hand tools	B1
Demonstrate the proper use of straight edge	B3
Demonstrate proper use of feeler gauges	B3, B6, B10, B11, E7, F1(10)
Demonstrate the proper use of torque wrench	B7, F1(11)
Demonstrate the proper use of dial indicator	B7, B11, E7, F1(678)
Check belt tension with the correct tool	D6, D11
Identify manufacturer provided tools	F1(11)
101 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Perform general engine inspection	A17
Understand and demonstrate visual inspection of engine and components	B8, F1(1), F1(2), F1(5)
Use of mechanical fasteners properly	B2
Demonstrate the proper use of sealants	B3
Demonstrate the proper use torque specs	B3
Use thread lubricant properly	B10, F1(10)
Clean components in preparation for reassembly	C1
Clean sealing surfaces and remove residual gaskets and seals	C1
Clean bolt holes	B7
Remove oil pan, cover and breathers	C1
Use Plastigage to check bearing clearance	C9, B11
Inspect oil pickup screen for cracks, holes and clogs	D2
Secure oil pick up screen properly	D2
Check lines and hoses for chaffing, damage, etc.	D4, D10
Check hose between drain and block for damage	D5
Check oil supply hose	D5

TABLE 1
Transit Bus Brakes Learning Objectives

Learning Objectives	ASE Task Reference
Identify location of thermostats (oil and water)	D8
Handle coolant and chemicals properly (environmental)	D9
Change coolant conditioner or additive package	D10
Check for proper torque on clamp	D10
Check pulley-to-belt surface for wear and clear debris	D11
Inspect clamps and hoses on water pumps	D11
Inspect shroud for damage	D12
Inspect radiator fins for damage and corrosion	D12
Inspect plug	D12
Inspect radiator to ensure it is free of blockages	D12
Inspect surge tank, lines, hoses and mounting surfaces	D12
Check condition of fan blades	D13
Check condition of fan shroud	D13
Ensure mounting surfaces are not cracked or broken	D13
Check for damage on cap seal and mounting seal	D14
Check for proper intake boot alignment and clamping (torque)	E1
Check seal between intake housing and engine compartment	E1
Look for corrosion on air cleaner housing	E1
Check for proper torque on V-band clamp	E2
Inspect turbo waste gate and rubber hose for holes, damage and clamping	E2
Check for damage on charge air cooler	E4
Inspect charge air cooler mounting brackets for damage	E4
Look for corrosion and dirty or damaged fins on charge air cooler	E4
Check mounting clamps	E5
Check pressure relief, short cycling (listening)	F1(1)
Visual inspection of system	F1(11)
Follow manufacturer maintenance procedures	F2(3)
Follow manufacturer's specs for fuel pressure	F2(5)

TABLE 1
Transit Bus Brakes Learning Objectives

101 PROCEDURES, INSPECTIONS & TESTING (ELECTRICAL-ELECTRONICS)	
Learning Objectives	ASE Task Reference
Visually inspect solenoids, sensors, etc.	F1(12), F2(6)
Visual inspection of wiring	F2(2)
Demonstrate repair procedures for metropak, deutsche, weather pack or other manufacturers and describe the connector differences	F2(8)
Name the various wire repair procedures, line splicing, etc.	F2(8)
Explain digital multimeter (DMM) functions, properly use multimeter	F2(2), F2 (4), F2(11)
Explain multimeter manufacturer safety procedures	F2(11)
Describe the difference between series and parallel battery arrangements	G2
Explain battery load test procedure	G2
Determine voltage of batteries, set charger to proper voltage	G3
Follow proper battery hook up sequence to prevent sparks	G4
Define system voltage and polarity	G4
Check for damaged wiring and proper mounting	G6
Describe battery charging procedures	G3
102 THEORY & UNDERSTANDING	
Learning Objectives	ASE Task Reference
Describe exhaust back pressure test procedures and equipment	A9
Explain how to use manufacturer's specification table to determine normal range of back pressure	A9
Explain how to use manufacturer's specification table to determine normal range of crank case pressure	A10
Use of manufacturer's specifications to determine which coolant to use	A14
Use of manufacturer's specifications to determine which lubricant to use	A15
Refer to manufacturer's specifications and bulletins	A18
Describe thread pitch and fastener grades	B2
Describe the importance of adhering to fastener replacement specs	B2
Explain fastener torque sequences and torque turn procedure for cylinder heads	B7
Explain lubrication, oil pump operating pressure and relief valve operation	D3
102 TOOL USAGE	
Learning Objectives	ASE Task Reference
Proper use of diagnostic equipment to determine if air in fuel supply system	A12
Use pressure gauge to check specific pressure	D1
Check pulley alignment with straight edge	D6
Using monometer check for air restriction	E1

TABLE 1
Transit Bus Brakes Learning Objectives

102 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Follow manufacturer procedures for inspecting and testing	B5
Follow manufacturer specs and/or use vendor tools for installation of engine components	B9
Following manufacturer's procedures, place engine in proper position for removal and installation of engine components	B10
Use a proper assembly lube as per manufacturer for engine rebuild	B11
Inspect removed engine gaskets or seals for evidence of proper sealing	C1
Secure applicable fasteners in accordance with manufacturer's specification	C1
Inspect breathers for blockage or contaminants	C1
Clean engine block, removing all scale, carbon, and other deposits	C2
Check oil passage in connecting rod, ensure free flow	C11
Rotate crank by hand to ensure no binding during engine rebuild	C14
Inspect ring gear for damaged teeth	C18
Check operation of sending unit	D1
Identify damaged mechanical fasteners, studs, and threaded holes	B2
Inspect for surface wear on block where O-ring seats	D2
Inspect pipe for cracks and O-ring damage	D2
Check sealing and mounting surfaces for damage	D4
Ensure crankcase breather is operating properly	D5
Adjust drive belts	D6
Inspect mounting surfaces on housing for debris, nicks, etc.	D11
Reinstall pulleys	D6
Pressure test cooling system.	D7, D14
Bleed air from cooling system	D9
Change coolant line	D10
Check coolant temperature in and out	D12
Ensure pressure release valve works	D12
Test pressure release cap	D12
Learning Objectives	ASE Task Reference
Ensure pressure release is in place and working properly	D14
Ensure specified pressure is not exceeded for that system	D14
Ensure proper rotation and orientation of fan	D13
Inspect and replace mounting bushings on fan brackets	D13
Check for chafing or holes in induction pipe and rubber boots; ensure boots remain pliable	E1

TABLE 1
Transit Bus Brakes Learning Objectives

Inspect waste gate linkage for movement and retainers	E2
Check intake manifold for leaks, cracks and missing or loose bolts	E3
Check hoses for holes and clamps (loose, damaged and correct)	E4
Pressure test charge air cooler and piping	E4
Check for V-band clamp condition	E5
Inspect for cracks on phlange exhaust manifold surfaces	E5
Inspect for exhaust manifold leaks and cracks	E5
Use DMM to test pumps, heaters, etc.	F1(2)
Check oil return lines	F1(3)
Use external pump / fuel source to check fuel system	F1(3)
Make mechanical connections, follow installation instructions for engine throttle and controls	F1(5)
Visual inspection of fuel system linkages	F1(10)
Apply manufacturer's procedures and tools when diagnosing and repairing fuel system	F1(6,7,8)
Make manufacturer recommended adjustments to fuel system components	F2(6)
Use DMM to check circuits and sensors	F2(6)
Use DMM to test voltage, perform voltage drop tests	F2(7)
Visually inspect circuits	F2(7)
Using wire terminal crimping tools	F2(8)
Use connector installation and removal tools (pin removers, etc.)	F2(8)
Apply basic electrical knowledge to electrical component perform tests and interpret readings	F2(11)
Perform state-of-charge test	G1
Safely load test a battery	G2
Determine which charging methods to utilize	G3
Check battery cables for corrosion, wear and crimping	G5
Inspect battery holes, cracks, leaks, bulged housing	G5
Test batteries for low electrolytes	G5
Check relays for arcing or melting housings	G6
Perform full field tests (or carbon pile load test) as specified	G7
Proper use of DMM clamp-on amps probe (high current)	G7
Use high current ammeter (1000 amp capacity)	G8
103 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Install engine block components	C1
Secure seals to components and prepare for installation	C1

TABLE 1
Transit Bus Brakes Learning Objectives

201 THEORY & UNDERSTANDING	
Learning Objectives	ASE Task Reference
Demonstrate familiarization with failure report system	A1
Perform road test procedures	A1
Describe EGR theory and application	E7
Describe J1708 and J1939 networking protocols	A16
Describe engine electronic control system	A12
Describe function and operation of vibration dampeners	A13
Explain effects of low or high fuel pressure on engine performance	F2(5)
Identify correct calibration and vehicle specifications using service manual	F2(9)
201 TOOL USAGE	
Learning Objectives	ASE Task Reference
Demonstrate proper use of tension gauge	B4
Demonstrate proper use of cylinder head pressure test equipment	B5
Demonstrate proper use of micrometers (spring height, bridge guides, etc.)	B4, B6
Properly use injector sleeve tools (various vendor provided tools)	B5
Properly use code reader, laptop, manufacturer diagnostic software or pro-link as necessary	A11, E7, F1(2), F2 (1), F2(2), F2(3), F2(4), F2(5), F2(7), F2(9)
Demonstrate proper use of diagnostic equipment to determine if air is in fuel supply system	A6
Use multimeter to check wiring harness	B8
Use proper tools to install seals which seals	D8
Demonstrate proper use of pin tools	F1(10)
Use test kit to check coolant and ensure additive package levels	D10
Use proper tools to avoid spreading rings	C13
Use feeler gauge to ensure proper clearance of end gap on piston rings	C13
Use listening tools to detect noises and harmonics	A4
201 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Identify damaged connectors and wires	A3
Demonstrate use of basic schematics and troubleshooting charts	A3, A11, A12, A16, F2(7)
Listen and detect normal and abnormal operating sounds	
Check for air inlet restriction	A5
Exhaust back pressure test	A5
Recognize normal vs. abnormal emissions characteristics	A5

TABLE 1
Transit Bus Brakes Learning Objectives

Determine if smoke source is from oil, fuel or coolant	A5
Determine if fuel return rate is within specifications	A6
Examine fuel for contamination	A6
Perform air intake system leak test under pressure	A7, A8
Determine possible causes of engine no start	A11
Inspect and repair engine mount system	A13
Pressure test coolant system	A14
Examine coolant for contamination	A14
Describe engine protection systems	A14, A15
Pressure test lube system	A15
Utilize proper disassembly procedures	B1
Measure deck-to-deck thickness	B3
Visual inspection for cracks, damage, passages, core	B3
Check and replace seals	B4
Visually inspect cam followers	B9
Inspect removed wear rings for proper sealing	C1
Disassemble bare block of all core plugs, galley plugs, fittings, nozzles, bearing caps, bearings and seals	C2
Install oil passage plugs	C8
Remove any oil passage plugs, clean oil passages	C8
Properly install bearings and races	C10
Check for stretched bolts and damaged threads	C11
Properly install piston rings	C11
Check for proper position of oil cooling jets	C15
Ensure oil cooling jets are free of debris	C15
Inspect vibration damper for damage and fluid leaks	C16
Align flex plate properly	C18
Check bolt holes for elongation	C18
Learning Objectives	ASE Task Reference
Inspect flywheel	C18
Check wiring from ECU to sensor	D1
Visually determine wear on oil pump	D2
Ensure relief valve and regulator are in correct place	D3
Measure distance for spring installation on oil pressure regulator valve	D3
Inspect thermostat for proper operation	D8
Check idler pulley bearings	D11

TABLE 1
Transit Bus Brakes Learning Objectives

Inspect drive gear for damage	D11
Inspect lubrication and cooling systems for damage	D11
Inspect inside of charge air cooler for oil contamination and coking	E4
Demonstrate knowledge of winterization procedures	E6
Check fuel system for air with proper manufacturer's procedure	F1(3)

202 THEORY & UNDERSTANDING

Learning Objectives	ASE Task Reference
Explain engine electronic control systems and sensor operation	A11, A16
Describe conditions that would activate engine protection systems	A12
Describe conditions that would cause abnormal engine/drivetrain vibrations	A13
Describe the interface between the engine and bus manufacturer specific devices (e.g., fire suppression)	F2(6)

202 TOOL USAGE

Learning Objectives	ASE Task Reference
Use micrometer for rocker arm shafts, bushings	B8
Use dial indicator for injector tip/nozzle protrusion	B5
Check end play with dial indicator, correct if necessary to proper specification	C9, C10
Check flywheel run out with dial indicator	C18
Demonstrate the proper use of gear removal and installation tools	C10
Check for wear on oil pump using feeler gauge and straight edge	D2
Use other specialized fuel system test equipment	F1(9)
Use DMM to check circuits and sensors	F1(12)
Use pop tester	F1(9)
Properly use code reader, laptop, manufacturer diagnostic software or pro-link as necessary	A12, A16, F2(1)
Proper use of injector height gauges	F2(4)

202 PROCEDURES, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference
Pressure testing of engine and subsystems	A2
Determine possible causes of exhaust temperature outside of normal ranges	A9
Troubleshoot cooling fan control operation	A14, A15
Examine for contaminated lubricating oil	A15
Check valve for discoloration, leakage	B4
Measure valve spring height, stems, and guides	B4
Remove injector sleeve	B5

TABLE 1
Transit Bus Brakes Learning Objectives

Inspect machined sealing surfaces for flatness, straightness, and irregular conditions	C1
Clean and inspect galley passages for blockage, restrictions, and obstructions	C2
Inspect engine block for cracks and erosion	C2
Inspect galley plug sealing surfaces for damage, install plugs and fittings	C2
Main bearing caps installed in proper sequence and orientation	C9
Check and adjust air gap using specification	C10
Check and set preload on tapered roller bearing	C10
Follow proper reinstall procedure drive gear train to ensure correct timing	C10
Inspect bearing journals and cam lobes for damage or excessive wear	C10
Check bushing bore	C11
Install and properly orient pistons, connecting rods and crank shaft	C11
Determine proper piston to cylinder bore clearance	C14
Check deck height on cylinder liner	C15
Measure vibration damper for run out	C16
Ensure proper torque sequence when installing head	C18
Use both electronic diagnostic and manual methods to verify oil pressure	D1
Verify engine oil pressure and check operation of pressure sensor	D1
Measure valve spring height and tension	D3
Check oil bypass valve and seat for damage	D4
Ensure correct orientation of oil cooler	D4
Replace bearings on pulleys and tensioners	D6
Use both electronic diagnostic and manual methods to check coolant	D7
Build replacement lines (fittings, hose types, crimping)	D10
Check for bearing wear	D11
Check for gear clearance (gear lash)	D11
Perform flow test	D12
Learning Objectives	ASE Task Reference
Check fan engaging at proper temperature	D13
Check fan speed	D13
Check mechanical and electronically fan controls	D13
Install piston rings in proper sequence with ring gaps staggered and orientated (top and/or bottom) correctly	D13
Determine that waste gate operates at proper boost pressure	E2
Electronically check turbo boost pressure in engine	E2
Inspect turbo for wear in shaft, damaged or missing fins, damaged housing, and leaking seals	E2

TABLE 1
Transit Bus Brakes Learning Objectives

Check pressure and temperature electronically to determine if they are within specifications	E3
Check for exhaust back pressure readings to determine if they are within specifications	E5
Check and monitor EGR sensors and valves electronically	E7
Determine whether to replace nozzle or whole injector	F1(9)
Read and interpret fuel pressure specification using the service manual	F2(10)
Use data from software to begin troubleshooting	F2(10)
Perform voltage drop tests on ground and power side	G7, G8
Test starting and charging systems using voltage drop test	G8
Perform starter amp draw test	A11
203 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Examine coolant for DCA level and chemical makeup	A14
Clean and inspect all fastener threaded holes for broken screws or thread damage, service and repair as needed	C2
Inspect all dowel pins and holes for damage, service and replace as needed	C2
301 THEORY & UNDERSTANDING	
Learning Objectives	ASE Task Reference
Describe operation of variable ratio/geometry turbo chargers	E7
301 TROUBLESHOOTING, INSPECTIONS & TESTING	
Learning Objectives	ASE Task Reference
Troubleshoot engine performance issues and causes	A1, A2
Troubleshoot engine electrical systems	A3
Troubleshoot noise origin	A4
Troubleshoot excessive smoke	A5
Troubleshoot fuel system	A6
Diagnose engine air induction restrictions	A7
Troubleshoot high intake restriction	A7
Troubleshoot air intake system	A8
Troubleshoot high exhaust back pressure	A9
Troubleshoot excessive crank case pressure	A10
Troubleshoot a no start problem	A11
Troubleshoot electronic and fuel controls	A12
Diagnose engine air induction leaks	A7

TABLE 1
Transit Bus Brakes Learning Objectives

Diagnose engine exhaust restrictions	A9
Troubleshoot vibrations	A13
Troubleshoot cooling system	A14
Troubleshoot fan clutch	A14
Troubleshoot surge tank system	A14
Troubleshoot water pump	A14
Troubleshoot filters	A14, A15
Troubleshoot hoses	A14, A15
Troubleshoot lubrication system	A15
Troubleshoot oil cooling system	A15
Troubleshoot oil pump	A15
Troubleshoot visual damage of engine and sub system components	A17
Determine if valves should be replaced or repaired	B4
Inspect cylinder walls for wear and damage if block is not equipped with cylinder liners	C4
Install and adjust camshaft followers	C7
Inspect gears for serviceability and determine if gears can be reused	C10
Diagnose temperature switch on the block	E6

302 TROUBLESHOOTING, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference
Evaluate engine diagnostic test results	A12
Troubleshoot high and low oil pressure readings	A15
Troubleshoot high oil consumption	A15
Interpret oil analysis results	A15
interpret engine diagnostic codes to determine needed repairs	A16
Perform fuel pressure test, inspect cylinder head and perform necessary repairs	B5
Inspect all mating surfaces for alignment and damage	C2
Install cylinder liners if equipped with seals, while adjusting liner height to manufacturer's specifications	C5
Install in block camshaft bearings	C7
Install in block camshaft, measure and adjust end play	C7
Determine acceptable wear on bearing, identify potential contamination in oil	C9
Check clearance between piston and wall	C12
Check cylinder wall for taper and out of round	C12
Troubleshoot electrical components of fan control between fan and ECU/OEM interface	D13

TABLE 1
Transit Bus Brakes Learning Objectives

Diagnose ether injection system (KBi)	E6
Diagnose the preheater and electronic control of preheater (ECU)	E6
Determine if a sensor or actuator is giving bad readings	F2(10)
Use mechanical gauges to double check electronic readings	F2(10)

303 TROUBLESHOOTING, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference
Troubleshoot electronic controls	A15
Troubleshoot source of contaminated lubricants	A15
Troubleshoot electronic diagnostics	A16
Check block for deck height and deck surface for flatness, warp age and finish, service as needed	C2
Install main caps and check line bore for alignment, service as needed	C2
Inspect cylinder sleeve counter bore and lower bore for distortion, taper, and sealing surface, service as needed if block has cylinder liners	C3
Inspect in block camshaft bearing bore surface for damage and dimensions/specifications, service as needed	C6
Check thrust bearing surface for wear and dimension, service as needed	C8
Clean and inspect crankshaft for cracks and damage using Magnaflux or other approved method	C8
Measure journal diameters for out-of-round and wear, service as needed	C8
Learning Objectives	ASE Task Reference
Check that con rods are not bent or twisted	C11
Check for cracks in rods if being reused	C11
Check block to ensure line bore is correct	C14
Install and align flywheel housing	C17
Perform run out check, ensure concentricity to face of fly wheel	C17
Demonstrate understanding of manufacturer's calibration procedures and authority to change or calibrate	F2(9)

400 MANUFACTURER SPECIFIC

Learning Objectives	ASE Task Reference
Perform manufacturer specified tests	E7
Manufacturer provided specialty tools	F1(5)

6. Exam requirements

The minimum acceptable grade to pass the course and all practical tests is 75 percent. Students must pass written tests with a minimum grade of 80 percent.

References

National Institute for Automotive Service Excellence (ASE) website. <http://www.ase.com/>

Abbreviations and acronyms

APTA	American Public Transportation Association
ASE	Automotive Service Excellence
ATU	Amalgamated Transit Union
DMM	digital multimeter
ECU	electronic control unit
EGR	exhaust gas recirculation
FMVSS	Federal Motor Vehicle Safety Standards
KBi	Kold-Ban International
MSDS	Material Safety Data Sheet
OEM	original equipment manufacturer
PPE	personal protective equipment
TWU	Transit Workers Union